IoT Levels

Developing an **IoT Level Template** system consists of the following components:

1. **Device:** These may be sensors or actuators capable of identifying, remote sensing, or monitoring.
2. **Resources:** These are software components on IoT devices for accessing and processing. storing software components or controlling actuators connected to the device. Resources also include software components that enable network access.
3. **Controller Service:** It is a service that runs on the device and interacts with web services. The controller service sends data from the device to the web service and receives commands from the application via web services for controlling the device.
4. **Database:** Stores data generated from the device
5. **Web Service:** It provides a link between IoT devices, applications, databases, and analysis components.
6. **Analysis Component:** It performs an analysis of the data generated by the Iol device and generates results in a form which are easy for the user to understand.
7. **Application:** It provides a system for the user to view the system status and view product data. It also allows users to control and monitor various aspects of the IoT system.

The IoT system consists of several systems which includes:

• Database: Database can be either local or in the cloud and stores the data generated by the IoT device.

• Web Service: Web services serve as a link between the IoT device, application, database and analysis components.

• Analysis Component: This is responsible for analyzing the IoT data and generating results in a form that is easy for the user to understand.

• Application: IoT applications provide an interface that the users can use to control and monitor various aspects of the IoT system. Applications also allow users to view the system status and the processed data.

IoT level-1

A level - 1 IoT system has a single node/device that performs sensing and/or actuation, stores data, performs analysis and hosts the application.

Level - 1 IoT systems are suitable for modelling low cost and low complexity solutions where the data involved is not big and the analysis requirements are not computationally intensive.

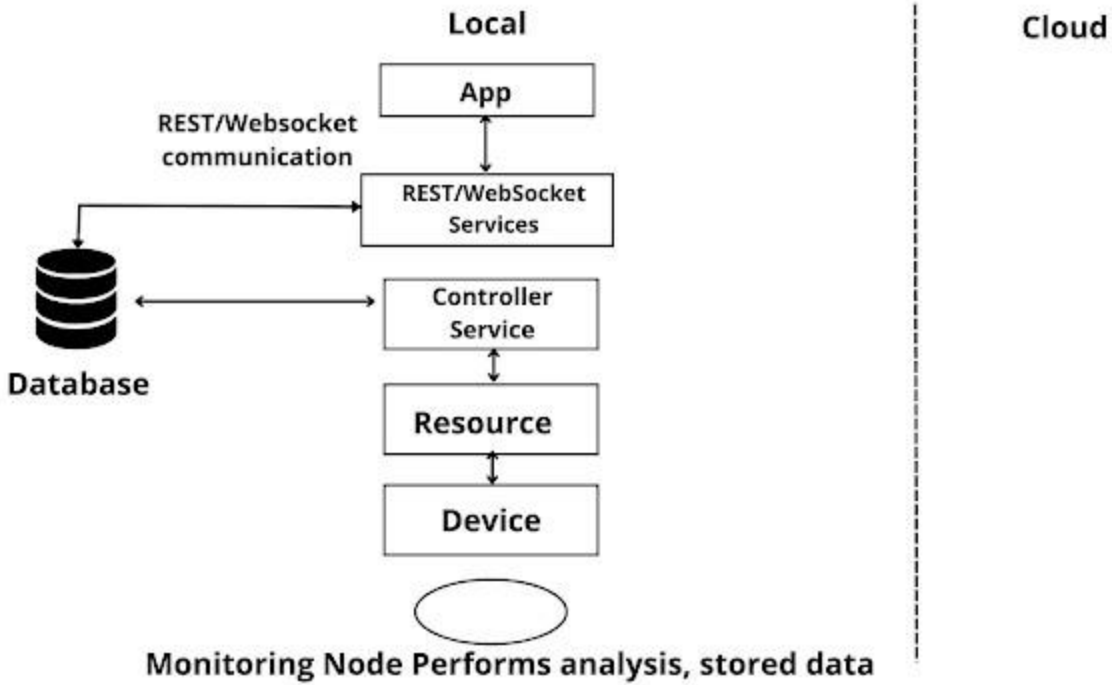
Example:

We can understand with the help of an eg. let's look at the IoT device that monitors the lights in a house.

The lights are controlled through switches.

The database has maintained the status of each light and also REST services deployed locally allow retrieving and updating the state of each light and trigger the switches accordingly.

For controlling the lights and applications, the application has an interface. The device is connected to the internet and hence the application can be accessed remotely as well.


Local
Cloud
App
REST/Websocket
communication
REST/WebSocket
Services
Controller
Service
Database
Resource
Device
Monitoring Node Performs analysis, stored data

IoT level-2

• A level-2 IoT system has a single node that performs sensing and/or actuation and local analysis.

Data is stored in the cloud and the application is usually cloud-based.

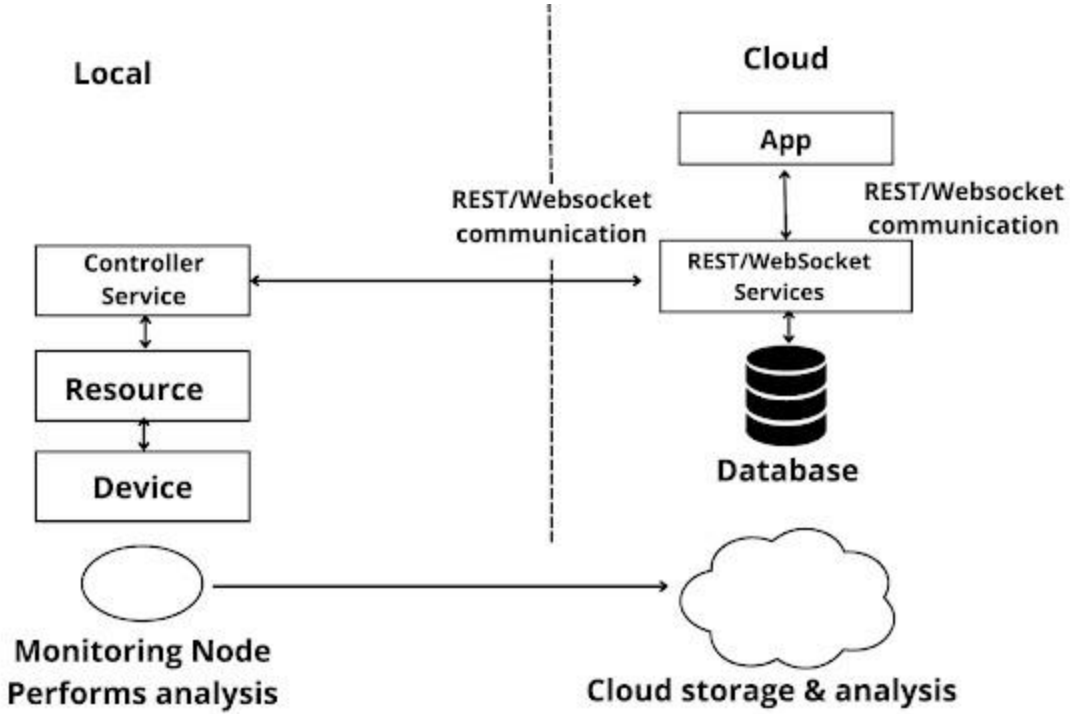
• Level-2 IoT systems are suitable for solutions where the data involved is big; however,

the primary analysis requirement is not computationally intensive and can be done locally.

Example: Cloud-based application is used for monitoring and controlling the IoT system

A single node monitors the soil moisture in the field Which is sent to the database on the cloud using REST APIS.

The controller service continuously monitors moisture levels.


Local
Cloud
App
REST/Websocket
communication
REST/Websocket
communication
Controller
Service
REST/WebSocket
Services
Resource
Device
Database
Monitoring Node
Performs analysis
Cloud storage & analysis

IoT level-3

- A level-3 IoT system has a single node.

Data is stored and analyzed in the cloud and the application is cloud-based.

- Level-3 IoT systems are suitable for solutions where the data involved is big and the analysis requirements are computationally intensive.

Example:

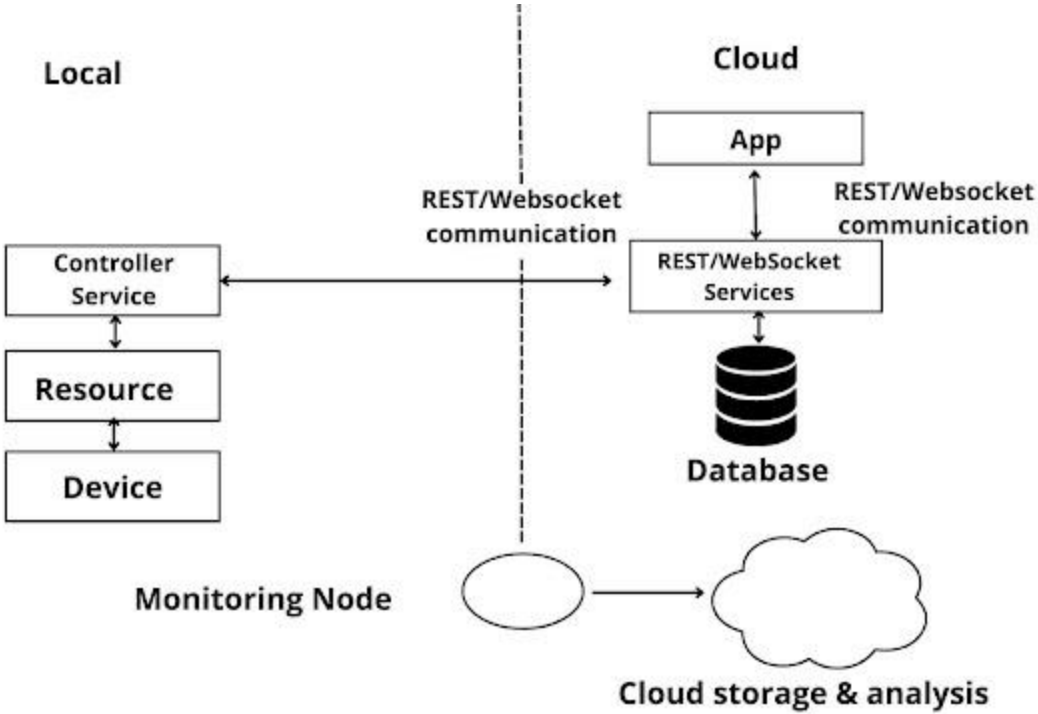
A node is monitoring a package using devices like an accelerometer and gyroscope.

These devices track vibration levels. Used to measure motion. (smartphones, gaming devices, cameras)

controller service sends sensor data to the cloud in the rear time using WebSocket APL.

Data is stored in the cloud and visualized using a cloud-based application.

The analysis component triggers an alert if vibration levels cross a threshold.


Local
Cloud
App
REST/Websocket
communication
REST/Websocket
communication
Controller
Service
REST/WebSocket
Services
Resource
Device
Database
Monitoring Node
Cloud storage & analysis

IoT level-4

- A level-4 IoT system has multiple nodes that perform local analysis.

Data is stored in the cloud and the application is cloud-based.

- Level-4 contains local and cloud-based observer nodes which can subscribe to and receive information collected in the cloud from IoT devices.

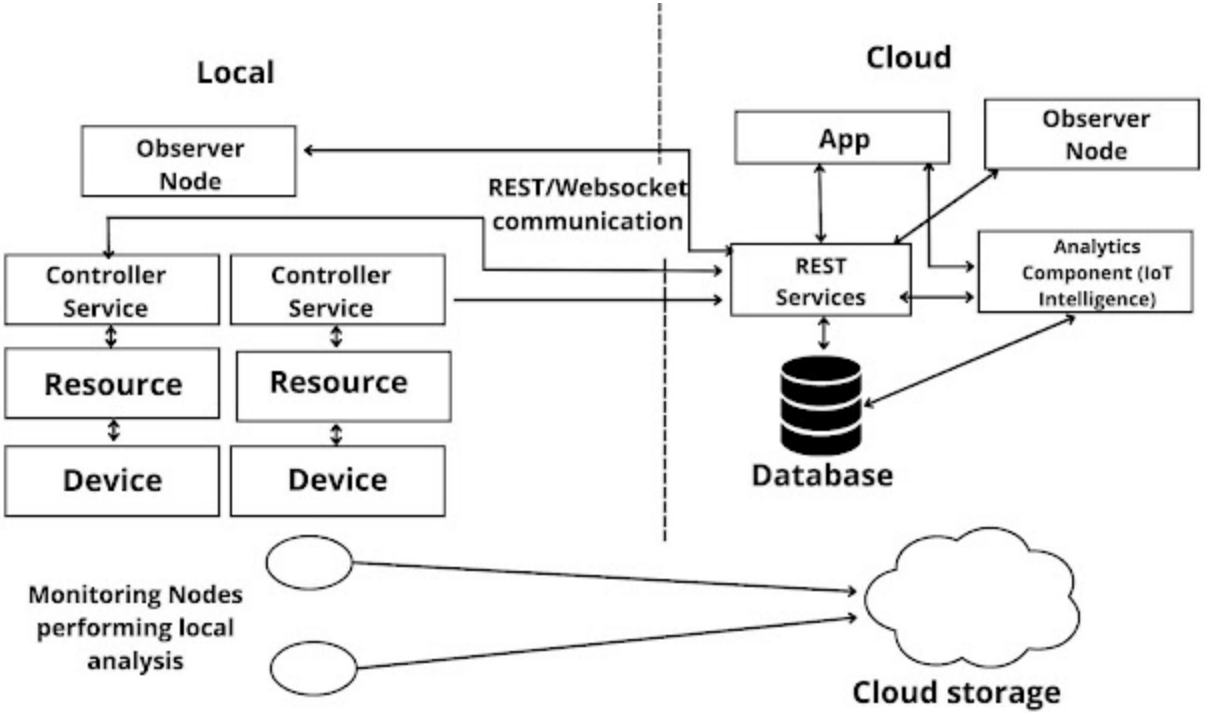
- Level-4 IoT systems are suitable for solutions where multiple nodes are required, the data involved is big and the analysis requirements are computationally intensive.

Example:

Analysis is done on the cloud and the entire IoT system has monitored the cloud using an application.

Noise monitoring of an area requires various nodes to function independently of each other.

Each has its own controller service. Data is stored in a cloud database.


Local
Cloud
Observer Node
App
Observer Node
REST/Websocket communication
Controller Service
Controller Service
REST Services
Analytics Component (IoT Intelligence)
Resource
Resource
Device
Device
Database
Monitoring Nodes performing local analysis
Cloud storage

IoT level-5

• A level-5 IoT system has multiple end nodes and one coordinator node.

The end nodes perform sensing and/or actuation.

The coordinator node collects data from the end nodes and sends it to the cloud. Data is stored and analyzed in the cloud and the application is cloud-based.

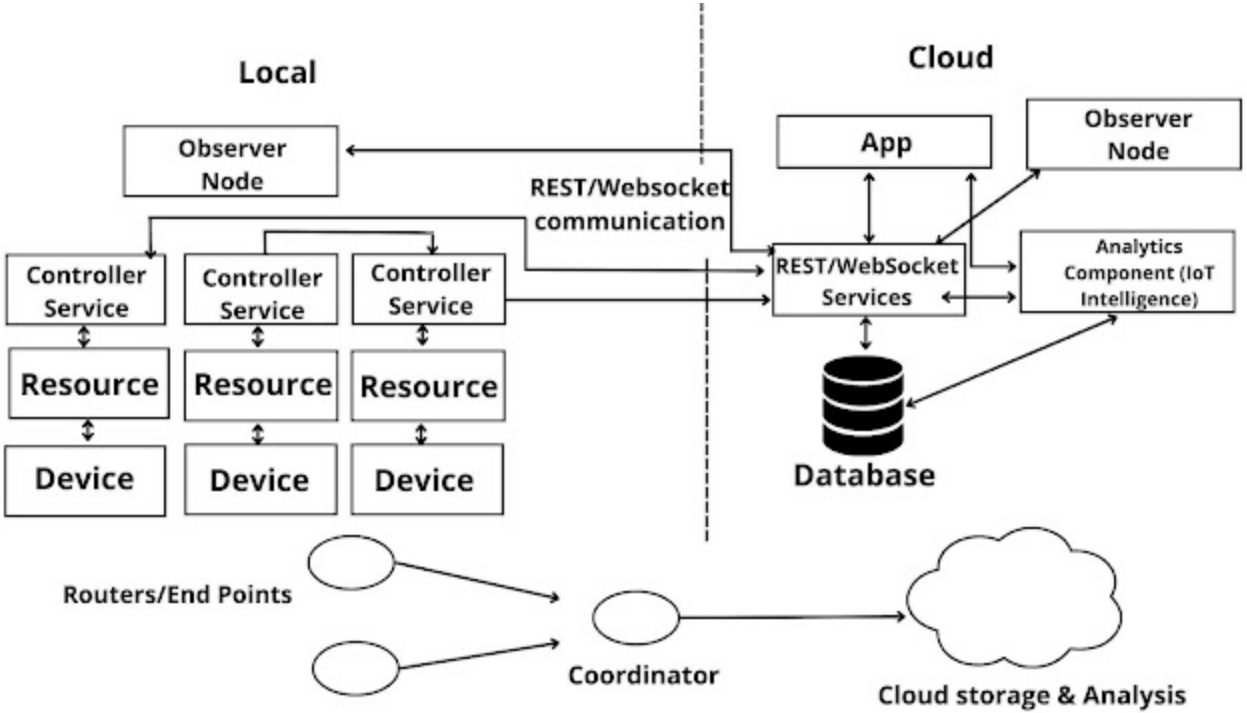
• Level-5 IoT systems are suitable for solutions based on wireless sensor networks, in which the data involved is big and the analysis requirements are computationally intensive.

Example:

A monitoring system has various components: end nodes collect various data from the environment and send it to the coordinator node.

The coordinator node acts as a gateway and allows the data to be transferred to cloud storage using REST API.

The controller service on the coordinator node sends data to the cloud.


Local
Cloud
Observer Node
REST/Websocket communication
App
Observer Node
Controller Service
Controller Service
Controller Service
REST/WebSocket Services
Analytics Component (IoT Intelligence)
Resource
Resource
Resource
Device
Device
Device
Database
Routers/End Points
Coordinator
Cloud storage & Analysis

IoT level-6

• A level-6 IoT system has multiple independent end nodes that perform sensing and/or actuation and send data to the cloud.

Data is stored in the cloud and the application is cloud-based.

The analytics component analyzes the data and stores the results in the cloud database.

• The results are visualized with the cloud-based application. The centralized controller is aware of the status of all the end nodes and sends control commands to the nodes.

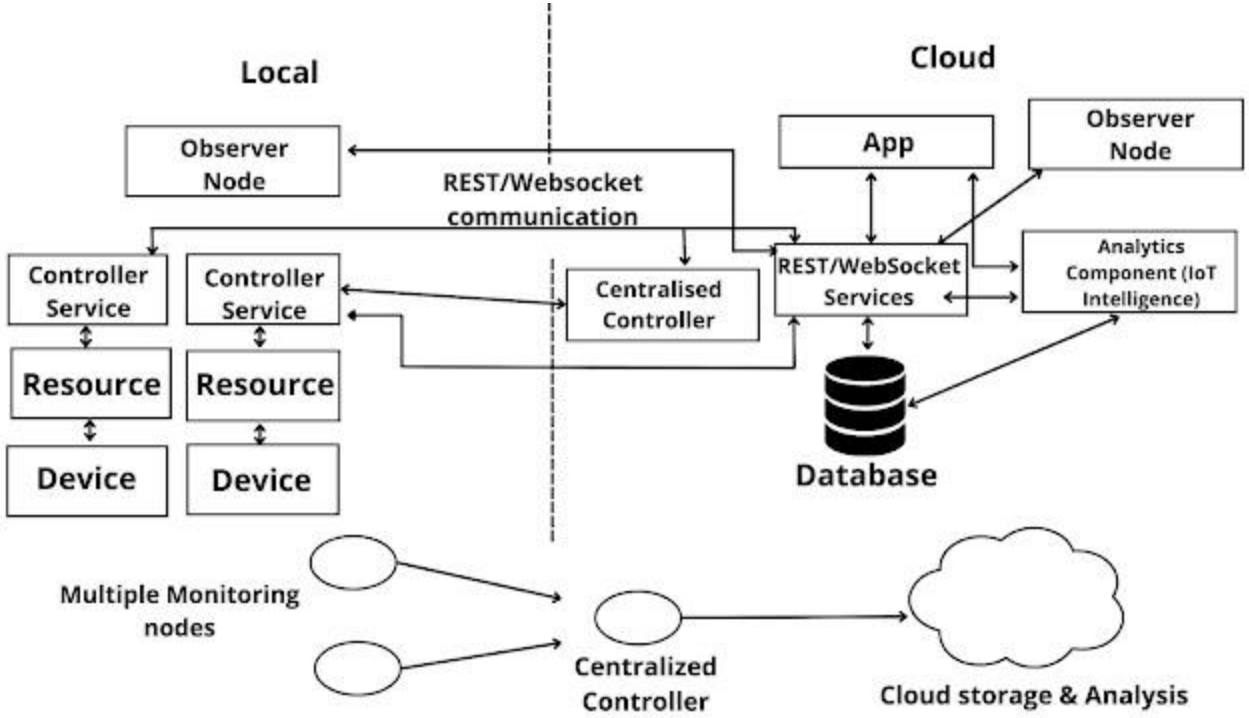
Example:

Weather monitoring consists of sensors that monitor different aspects of the system.

The end nodes send data to cloud storage.

Analysis of components, applications, and storage areas in the cloud.

The centralized controller controls all nodes and provides inputs.


Local
Cloud
Observer Node
REST/Websocket communication
App
Observer Node
Controller Service
Controller Service
Centralised Controller
REST/WebSocket Services
Analytics Component (IoT Intelligence)
Resource
Resource
Device
Device
Database
Multiple Monitoring nodes
Centralized Controller
Cloud storage & Analysis

Thank you